Impact of a bidirectional approach via radial and popliteal arteries for the treatment of chronic total occlusion of lower limb artery: A case report

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A 49-year-old man with poorly controlled diabetes was admitted to Kushiro Rosai Hospital, Hokkaido, Japan after scalding both feet with boiling water. Because of poor healing, he was assessed for peripheral arterial disease. Angiography revealed total occlusion of the right common and external iliac arteries, diffuse stenosis of the right superficial femoral artery, focal stenosis of the left common iliac

artery and chronic total occlusion of the left superficial femoral artery. A staged procedure with bidirectional approach via the radial and popliteal arteries was attempted. During the procedures, the patient was in the prone position on the catheterization table, and bidirectional guidewire manipulation was performed. All of the lesions were successfully stented. The patient was not required to change positions during the procedure, which can be performed by a single operator. The bidirectional approach is effective in the setting of transcatheter treatment of chronic total occlusive disease.

Key Words: *Blood access, Interventional radiology, Popliteal artery*

Although almost two decades have passed since the first report of transpopliteal angioplasty (1), the technique is not widely used. Obstacles to performing the procedure may include the close proximity of the popliteal vein and nerve to the popliteal artery, as well as the difficulty in puncturing the artery itself. However, in a completely occluded superficial femoral artery, the guidewire may not necessarily cross the lesion when using a unidirectional, antegrade approach. Cases are often encountered in which a bilateral antegrade-contralateral and retrograde-ipsilateral femoral approach is quite effective for the treatment of iliac occlusive disease. This useful bidirectional approach can also be applied to endovascular treatment of occluded superficial femoral arteries.

We report the case of a patient suffering from diffuse iliac and superficial femoral artery stenosis, with chronic total occlusion of both lower extremities. All lesions were treated with a bidirectional approach, illustrating the efficacy of this technique.

CASE PRESENTATION

A 49-year-old man with poorly controlled diabetes and paralyzed in the lower half of his body was admitted to Kushiro Rosai Hospital, Hokkaido, Japan, after scalding both feet with boiling water. Despite plastic surgery intervention, the scalds to his feet did not heal. Due to irreversible spinal damage and the subsequent paralysis sustained by the patient in a traffic accident while in his 20s, the patient was unaware of intermittent claudication. Peripheral arterial disease (PAD) was suspected, and the patient was referred

for cardiovascular assessment with a view to transcatheter revascularization.

On examination, the right and left ankle-brachial pressure indexes were 0.41 and 0.81, respectively. Angiography revealed total occlusion of the right common and external iliac arteries, diffuse stenosis of the right superficial femoral artery, focal stenosis of the left common iliac artery and chronic total occlusion of the left superficial femoral artery (Figure 1). A staged percutaneous transluminal angioplasty with bidirectional approach via the radial and popliteal arteries was planned. In the first stage, the right iliac and superficial femoral arteries were treated. The patient was placed in the prone position on the catheterization table. A 5 Fr Optiflush diagnostic multipurpose catheter (Terumo Medical Corporation, Japan), 150 cm in length, was advanced via the left radial artery toward the proximal edge of the right iliac lesion, and inserted into the right popliteal artery under angiographic guidance. Because there was a dimple at the distal end of the right iliac lesion, a 0.018 in Neo's Treasure guidewire (Getz Bros, Asahi Intec, Japan) and a 0.035 in Radifocus guidewire (Terumo Medical Corporation) with angle or straight tip were retrogradely advanced. In spite of careful manipulation, the guidewires entered the subintimal space and could not be manipulated into the true lumen. Subsequently, a 0.035 in Swan-Excel guidewire (AuBex Medical, Japan) was inserted via the left radial artery, which was successfully passed across the length of the lesion. During the antegrade guidewire manipulation, the retrograde guidewires were left within the external iliac subintimal space as a landmark. Once the

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Figure 1) Diagnostic angiography revealed total occlusion of the right iliac artery, diffuse stenosis of the right superficial femoral artery, focal stenosis of the left common iliac artery and total occlusion of left superficial femoral artery

guidewire entered the popliteal catheter introducer, the approach was changed from antegrade to retrograde. A 5.0 mm × 80 mm Wanda balloon catheter (SciMed, Boston Scientific, USA) easily crossed the iliac lesion and was inflated twice. After the predilation, a 6.0 mm × 40 mm Palmaz stent (Cordis, Johnson & Johnson, USA) was placed at the proximal common iliac lesion and a 7.0 mm × 67 mm Wall stent (SciMed, Boston Scientific) was used to cover the residual iliac lesion; postdilation was then performed with the Wanda balloon catheter. With regard to the right superficial femoral lesion, a 8.0 mm × 80 mm Smart-Control stent (Cordis, Johnson & Johnson) and a 8.0 mm × 66 mm Wall stent were deployed at the proximal and distal part of the lesion, respectively; postdilation was performed using a 4.0 mm × 100 mm Opta-Pro balloon catheter (Cordis, Johnson & Johnson). Final angiography revealed good dilation of both iliac and superficial femoral lesions (Figures 2 and 3).

Two days later, the second stage of the procedure was performed by applying the same strategy to the left side. We first advanced a 0.014 in V-18 control guidewire (SciMed, Boston Scientific) via the left popliteal artery; however, the guidewire

Figure 2) A Preprocedural antegrade angiography showing total occlusion of the right common iliac artery; B Preprocedural retrograde angiography showing total occlusion of the common femoral artery; C Postprocedural angiography showing successful revascularization of the previously occluded iliac artery

Figure 3) Angiography of the right right superficial femoral artery. **A** Preprocedural angiography showing diffuse stenosis; **B** Final angiography showing satisfactory blood flow after stenting

entered the subintimal space of the totally occluded superficial femoral artery. A 0.035 in Swan-Excel guidewire was subsequently advanced via the left radial artery and it successfully crossed the left superficial femoral artery lesion. Predilation was performed with a 4.0 mm × 80 mm Wanda balloon catheter, and the left superficial femoral lesion was then treated with a 8.0 mm × 80 mm Smart-Control stent and a 8.0 mm × 66 mm Wall stent. Postdilation was performed using the same Wanda balloon catheter (Figure 4). Next, a 6.0 mm × 40 mm Palmaz stent was directly advanced and implanted at the left common iliac lesion. All target lesions were successfully and safely dilated using the bidirectional approach via the radial and popliteal arteries. The patient's scald began to heal thereafter.

DISCUSSION

PAD has attracted considerable attention in recent years, not only because it results in critical limb ischemia (CLI) and (possibly) amputation, but also because it reflects systemic arteriosclerosis. It is well known that morbidity of PAD itself is a predictor of poor prognosis, and stroke and heart attack are a major cause of death in PAD patients (2,3). Therefore, pharmacological intervention, such as aggressive lipid-lowering therapy, is essential for PAD patients as well as those with

Figure 4) Angiography of the left superficial femoral artery. **A** Preprocedural retrograde angiography showing total occlusion; **B** Postprocedural angiography showing satisfactory blood flow after stenting

coronary artery disease. Although some investigators define PAD as a benign disease because of the small number of patients who are classified into Fontaine subclass-II and who will need revascularization or limb amputation in the future, it is undoubtedly true that the number of patients who are suffering from systemic atherosclerosis leading to CLI is increasing (4,5).

Almost two decades have passed since Tonnesen et al (1) first reported transpopliteal angioplasty. Although their idea was ground-breaking, this strategy has not as yet come into wide use. Reasons for not performing transpopliteal angioplasty may include the difficulty in puncturing the popliteal artery, and that the vein and nerve are closely situated and may be obstacles to performing the procedure. Because the popliteal vein is usually located directly over the popliteal artery, we ask patients to twist the affected leg inward and advance the puncture needle as medially as possible to avoid popliteal vein injury.

Although surgical revascularization should be the first choice for the treatment of complex disease, there has recently been increasing interest shown in endovascular treatment, even in cases of total occlusion (6). When the anterotibial or posterotibial artery is selected as the retrograde approach site for the bidirectional procedure, patients can lie in a supine position on the catheterization table. However, the tibial artery is relatively narrow, and large-sized balloon catheters and stent-delivery systems cannot be advanced via below-ankle arteries. The popliteal artery is the better candidate for retrograde approach site because a large-sized catheter introducer, 6 Fr or greater, can be inserted. There is some consensus that the brachial artery is better as antegrade blood access site than the radial artery because a larger-size catheter (eg, 8 Fr) can be used. However, the patient must change position from supine to prone during the procedure. It is controversial whether bidirectional guidewire manipulation is necessary in all cases of iliac or superficial femoral artery disease. In simple cases, the guidewire can be advanced in a unidirectional fashion; however, there are cases in which a bilateral antegrade-contralateral and retrograde-ipsilateral femoral approach is quite effective, such as intrapelvic short occlusion of iliac

artery. In our first procedure, the right iliac artery was diffusely occluded from the common iliac bifurcation to the common femoral artery, and it was decided that an antegrade approach via the contralateral femoral artery would not provide enough back-up force to advance the guidewire. Moreover, our patient suffered from diffuse stenosis of the right superficial femoral artery. Thus, we decided to perform a bidirectional approach via the radial and popliteal arteries to establish a procedural system with adequate back-up support for precise guidewire manipulation, to treat both the iliac and superficial femoral arteries in a single procedure.

CONCLUSIONS

We report a case of CLI resulting from severe PAD. Appropriate revascularization is essential for improvement of prognosis of PAD patients and endovascular intervention should play much more important roles. A bidirectional approach strategy using the radial and popliteal arteries, which we presented in the present report, is potentially one of the most useful techniques in the field of transcatheter treatment of iliac or superficial femoral artery occlusions.

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